

Exploring Stars from Deep Underground: Status and Perspectives at LUNA

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For almost three decades, the Laboratory for Underground Nuclear Astrophysics (LUNA) under the Gran Sasso mountain in Italy has provided the ideal site for pioneering measurements of key nuclear reactions for astrophysics. Here, experimental studies of hydrogen burning reactions in the pp-chain, the CNO cycles, and NeNa-MgAl cycles have led to major advances in our understanding of nucleosynthesis processes in various environments, from the Big Bang, to our Sun, to Asymptotic Giant Branch stars and classical novae (see [1] for a recent review). Now, a new phase has just begun devoted to the study of helium burning processes, with the investigation of the $^{13}\text{C}(\alpha, n)^{16}\text{O}$ and the $^{22}\text{Ne}(\alpha, \gamma)^{26}\text{Mg}$ reactions currently underway.

In this talk, I will review some recent results obtained by the LUNA Collaboration and present exciting opportunities that will soon open up with the installation of a new 3.5MV accelerator underground.

[1] C. Broggini *et al.*, Progress in Particle and Nuclear Physics 98 (2018) 55-84.